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CAUSATIONS OR PAYOFFS? THE INTERACTION BETWEEN COUNTRIES' ECONOMIC RESULTS AND COMPETING PROXIES OF SOCIAL CAPITAL

Liana Isayan*
Armenian State University of Economics,
Yerevan, Armenia
E-mail: Liana.isayan@asue.am
OCRID 0000-0003-0091-645X
**Corresponding author*

Firuza Mayilyan
Armenian State University of Economics,
Moscow State University named after M.V. Lomonosov,
Yerevan branch, Armenia
E-mail: firuza.mayilyan@asue.am
OCRID 0000-0003-0655-6176

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ABSTRACT. The repository of literature studying the relationship between economic indicators and social capital through traditional surveys data is growing. At the same time, the emergence of social networks has created competing big data that require in-depth analysis and comparison of results. The aim of this research is to analyze the interaction between countries' economic outcomes and proxy indicators of social capital, considering and comparing the traditional data of surveys and Facebook's data of social connectedness index. Correlation analysis, Granger and Dumitrescu Hurlin Panel Causality tests, Ordinary Least Squares (OLS) regression methods of analysis on panel and cross-country data are used to show that countries' GDP per capita indicator is a cause for higher social capital, while social connectedness indicators explain only a very small part of the GDP per capita indicator. It is also shown that institutional trust and networks elements of social capital are the most influential and statistically significant explaining variables of GDP per capita (in case of the latter variable, the connection is two-sided). The scientific contribution of this study is that it brings research growing in two different directions into one dimension. The results of the analysis are also of practical importance for public policy development, social media companies and the buyers-users of their data.

JEL Classification: A13, Z13

Keywords: social capital, social connectedness, economic growth, GDP per capita, Granger Causality, Dumitrescu-Hurlin Panel Causality, OLS

Introduction

The theory of social capital already has a long history with the well-known works of its main representatives, among which are J. Coleman (1988), R. Putnam (1994), P. Bourdieu (1986), F. Fukuyama (2000), E. Ostrom (2011) and others. However, the elements attributed to it (trust, norms, personal ties, etc.) are so diverse that different authors, taking its different elements, sometimes come to different conclusions about the same problem. In the most well-known example studying this connection, S. Knack and P. Keeffer show a positive connection

between the trust element of social capital and the strong economic performance (Knack & Keeffer, 1997), while another study concludes that the impact of social capital on the overall result disappears in the case of developed institutions (Ahlerup et al., 2009). Notably, J. Stiglitz sees this phenomenon as a transformation of social capital, a transition from one form of social capital (interpersonal trust) to another (trust in institutions), rather than the neutralization of the influence of social capital (Stiglitz, 2000, 63-65). We agree with Stiglitz's approach, which is essentially the synergetic approach to the definition of social capital, and hereafter talking about social capital we will be guided by the following definition: *the social capital of an individual country refers to the strength of interpersonal and individual-institutions relations, which affects the economic outcomes* (Hayrapetyan and Isayan, 2022).

Social capital, as an element of capital displayed in relations between members of society, both directly (for example, the effect of trust on GDP growth) and indirectly (in return for investments in education and human capital) affects the results of the country's economic activity. In the category of social capital, the word "capital" itself emphasizes the important role of social capital in economic results. Moreover, logically, at least some elements of social capital must be related to many different economic phenomena, such as poverty, investment, prosperity, economic growth, etc. In particular, it is obvious that in case of a high level of cooperation in the society the end results will be significantly higher due to savings of transaction costs, like in the explanation of the idea of the invisible hand by P. Heyne's (2014, 2) traffic jam example. There are also more specific works on the topic, in which the mechanism is presented indirectly: by the example of a particular sector or community or through indicators that are indirectly related with economic growth and development (e.g. Lushi et al, 2021; Kokthi et al, 2021).

The undeniable impact of social capital on economic phenomena is expressed through the functions of social capital, which include:

- social capital facilitates personalized informal relationships between market agents reducing transaction costs; this function of social capital is mostly used in the implementation of high-risk innovation projects in the market of specific assets;
- it helps to reduce coordination related transaction costs at the organization level and to mitigate the "principal-agent" problem within an organization;
- at the macro-level (interaction between the state, business, trade unions and society) social capital contributes to the growth of public confidence in the state, social stability and ultimately to economic growth.

The interaction between social capital and economic phenomena is much discussed at the macro level, particularly in terms of interaction with economic growth. But what specific elements of trust do interact with economic outcomes, and in what direction does that interaction take place, if it exists? And most importantly, do relationships moved to online platforms in modern society follow the same rules to which the relations traditionally measured by social surveys have been subjected for years? The aim of this analysis is to answer raised questions which are especially important after the global pandemic and in the conditions of escalating military-political tensions around the world since both of these factors are generally considered as threat to trust and cooperation, as well as they are directly related to social connectedness (Bartscher et al., 2021; Kuchler et al., 2021; Grosjean P., 2019). The work has the following structure: firstly, a literature review will be conducted on the topic, then the methodology and data used in this article will be presented, and finally the main results and conclusions of the analysis will be delivered. This analysis is to enrich the studies on the interaction between economic growth, stock indicators of economic outcomes and social capital by comparing the traditional and contemporary proxy indicators of social capital, which is the novelty and the main contribution of this work to the field.

2. Literature review

There are a lot of works on the connection between social capital and economic payoffs (e. g. Narayan and Protcheth, 1999; Beugelsdijk and Schaik, 2001; Dasgupta, 2002; etc.), yet currently, starting from the 1990s, the dominant approach is probably the theory of modernization, according to which "economic development is associated with shifts away from absolute norms and values toward values that are increasingly rational, tolerant, *trusting* and *participatory*" (Inglehart and Baker, 2000).Meantime, the availability of new data and the emergence of new methods promote some other waves of analysis in this topic which will be briefly presented below.

One of the early studies on this topic is by Knack and Keefer who, using World Values Survey's data, point out that a 1 percentage point improvement in the confidence level could increase the country's GDP by more than 0.5 percentage points (Knack & Keeffer, 1997, 1251-88). Another example is the theoretical model proposed by Dasgupta according to which social capital affects both the income of an individual and the factor productivity of the society as a whole (Dasgupta, 2002). According to this approach, the full factor productivity function has the following appearance:

$$Y=AF(K,H),\ A>0,$$

where

Y is the quantity of the product being produced,
A is the index of institutional capacity, which includes the dominant system of property rights and the level of public trust,
K is the physical capital,
and *H* is the aggregate index of human capital, which will be calculated in an economy, consisting of a number of agents, as the product of the quantity of labor (L) and the human capital of one agent (h).

All else being equal, the economy will produce more products if its members trust each other and have a common set of values. Of course, under stable institutional conditions the volume of production will be conditioned by investments in human and physical capital. Moreover, the growth of public trust in a society contributes to both the growth of institutional capacity and the growth of aggregate human capital, and the extent of the impact depends on the extent to which social capital is manifested as a public good. That is, if the externalities of social capital are limited to a small group of people, the impact will be greater on the human capital of individuals, while in case if it is a public good, it will affect the institutional capacity index (Dasgupta, 2002, 31-34).

J. Stiglitz presented another fundamental analysis of social capital as an institutional factor explaining economic growth. According to the author, as a society develops economically, its social capital, including tacit knowledge, aggregate connections and authority, as well as organizational capital must be adapted allowing interpersonal connections to be partially replaced by formal institutions of market economy, such as the structured system of laws imposed by the government. This process may initially lead to a reduction in social capital, but will gradually lead to the creation of a new quality of social capital, in which case social relations are embedded in the economic system, and not vice versa. In other words, the author presents the relationship between social institutions and economic growth to be U-shaped. In the initial stage of the development of market economies, when the markets are narrow and incompletely formed, the role of informal norms is especially important. In particular, in such a situation interpersonal social ties solve the problems of distribution and redistribution. Then, as a result of a drastic change or reversal, social capital weakens with the old ties disappearing; the revolted past reduces the motivation to invest in the mechanisms of

reputation, so the value of interpersonal relationships, and consequently the value of social capital, decreases. However, when the modern capitalist state matures, the hierarchical system of government, the legislative system, the rules and regulations replace the "community" as the controller of social, business and personal contracts. That is, one form of social capital is replaced by another. The production chain is gradually being replaced by quality control frameworks, where employees are in a better position to control their coworkers than employers. In other words, we return to the horizontal relations again (Stiglitz, 2000). Meantime, according to Stiglitz and co-author Arnott, a real catastrophe will occur when the states are strong enough to eliminate the current state of cooperation but are not capable enough to replace it with something less arbitrary (Stiglitz & Arnott, 1991, 179-90).

D . Narayan and L . Pritchett analyzing household expenditure statistics from 50 villages in Tanzania found that where the level of social activity is high, per capita incomes of households are higher (Narayan & Pritchett, 1999, cited by Mailyan F.). Among the analyzes related to this issue is the work of Fedderke et al.on the role of social norms and rules in ensuring economic development by reducing transaction costs while insisting that not all forms of social capital are equivalent, and therefore only some of them contribute to economic development (Fedderke et al., 1999, 709-745). In another research related to the topic, Beugelsdijk and Schaik, following the hypothesis proposed by Putnam according to which the membership of different groups has a positive relationship with economic growth, show that the membership of groups in Europe really has a positive relationship with regional economic growth with the example of 54 regions in Europe. It's worth noting that though the trust in a society is believed to have a significant impact on an individual's decision to become an entrepreneur and it's obvious that a government that enjoys a high level of trust has a great potential to effectively implement its economic policy in any society, Beugelsdijk and Schaik claim that the results of their research do not show a connection between the level of trust and economic growth (Beugelsdijk & Schaik, 2001).

There are also more recent works on this topic by already well-known representatives of the sphere (e.g. Veselov and Yarkin, 2022; Auzan et al.,2020; Bakhtigaraeva and Stavinskaya, 2020;Westlund and Larsson, 2020), however, the representatives of network connection theory have relatively new things to say in terms of used tools. Among the representatives of this direction M. Jackson, for example, concludes in his research that relationships in the labor market lead to correlated outcomes for neighbors (Jackson, 2008). In commercial markets these outcomes are related to the types of relationships, in some cases providing greater positive results with strong networks and in some cases weaker ones. For example, a strong network of connections is of high importance in the information exchange markets. In his turn, S. Goyal has devoted an entire chapter of his famous work "Connections" to the study of network connections in the labor market (Goyal, 2007, 289). The other major representative of network theory R. Kranton co-authored works directly related to economic phenomena, such as on "Buyer-Seller Theory" (Kranton R. and Minehart, 2001) and "Public goods in networks" (Bramoullé and Kranton, 2007). In addition, Acemoglu et al. also touched upon these relationships modeling the impact of inter-firm relationships on the macroeconomic situation of a country (Acemoglu et al., 2012). It should be noted that in the context of network theory, of course, there are controversies as to which types of connections are particularly conducive to achieving the desired economic outputs (for example, Coleman's closed network approach versus Bart's structural holes - open networks approach; Beugelsdijk and Schaik, 2003, 7).

Finally, the availability of social media data for usage has given rise to a new wave of research on this topic. Thus, on the one hand, many researchers have begun to use social networks as a tool for surveys and experiments (eg. Enikolopov et al., 2020), on the other hand, various studies actively use the already public data of social networks like the Facebook social

connectedness index data. Examples of the latter are the study on the role of social networks in bank lending (Rehbein and Rother, 2020), the interaction between housing transactions and social networks (Bailey et al., 2018a), international trade and social connectedness (Bailey et al., 2021), etc. However, even in very recent works on this topic (see for eg. Muringani and Fitjar, 2021; Abu-Ismail and Ishak, 2021; Roth, 2022, etc.), the big data from social media is not well used while studying the interaction between economic outcomes and social capital. The latter is still measured by using traditional surveys data. So, this work is to fill that void analyzing the interaction between social capital and economic outcomes using the data from social media and comparing it with social capital estimates obtained through traditional surveys.

3. Methodology

To answer the research questions, a study of the interaction between social capital, social connectedness index, and the group membership indicators from one hand and the economic growth, GDP per capita and its growth rates from the other hand is carried out using the methods of correlation analysis, Granger and DumitrescuHurlin Panel Causality tests, OLS regression analysis technics.

The stationarity of the series has been checked using the Augmented Dickey – Fuller (ADF) test. The Significance of the correlation coefficients were tested by pared t-test, the null hypothesis for which is the following: "The population correlation coefficient IS NOT significantly different from zero". The t-statistic was calculated by the following formula: $t = \frac{r\sqrt{(n-2)}}{\sqrt{(1-r^2)}}$, where r is the correlation coefficient between the two series and n is the number of observations (Devore & Berk, 2012). Granger and Dumitrescu-Hurlin Panel Causality tests were applied to find out the exact directions of interactions (the latter is used wherever panel data was available). The significance of the Granger and Dumitrescu-Hurlin Panel Causality tests coefficients was checked by F-statistic and W and Zbar statistics respectively. For the OLS regression models Durbin-Watson (DW) statistic was calculated to check autocorrelation in model residuals. Breusch-Pagan-Godfrey (BPG) test for heteroscedasticity and Jarque-Bera (JB) test for normal distribution were performed.

The analysis is based on the following data sources: Legatum Institute databases (Legatum Prosperity Index 2008-2020[1]), Facebook's Social Connectedness Index (updated as of September 21, 2020, data notes), WVS databases (including the most recent Joint EVS / WVS 2017-2021 data- set), World Bank's databases (2008-2020), as well as national statistic services' databases of considered countries.

Three proxy measures of social capital from mentioned databases are used here, from which the first one is the social capital pillar of Legatum Prosperity Index calculated as the weighted average of normalized 5 elements with 17 indicators with the following equations:

(1) $E = 100 * \frac{\sum_{j=1}^{n} w(j)*ind(j)}{\sum_{j=1}^{n} w(j)}$, (2) $P = \frac{\sum_{j=1}^{m} K(j)*E(j)}{\sum_{j=1}^{m} K(j)}$, where

P is the pillar (in this case it's social capital),

E is one of the 5 elements,

W(j) and K(j) are the weights of considered indicators and elements respectively (LI, 2019).

The second proxy indicator is Facebook's social connectedness index which is calculated with the following formula:

(3) $SocialConnectednessIndex_{i,j} = \frac{FB_{Connections(i,j)}}{FB_{Users(i)}*FB_{Users(j)}}$, where

FB_Users_i and FB_Users_j are the numbers of Facebook users in locations i and j, and $FB\_Connections_i$ is the total number of Facebook friendship connections between individuals

in the two locations. The publicly available measures of the Social Connectedness Index are scaled within each dataset to have a maximum value of 1,000,000,000 and a minimum value of 1. As a result, the public release version of the $SocialConnectednessIndex_i$, measures the relative probability of a Facebook friendship link between a given Facebook user in the location i and a given user in the location j (Bailey et al., 2018b). Note that when analyzing this data it was divided into 2 parts, separating indicators into internal and external social connectedness (inside the same country and with the external world).

The third proxy indicator is the groups' participation rate calculated following Putnam's approach of the measurement of social capital and based on the answers to the following questions of WVS: "Now I am going to read out a list of voluntary organizations; for each one, could you tell me whether you are a member, an active member, an inactive member or not a member of that type of organization?". It is calculated as the weighted average of all groups' memberships' (%) taking inactive memberships equal to 0.5.

Table 1. Descriptive statistics for considered indicators

Variables	y	Mean	SD	Range	Skewness	Kurtosis	Median	ADF (t-stat)
Economic Growth, %	145 (2002)	2.73 (3.6)	2.66 (5.0)	17.5 (185.2)	-0.64 (5.2)	2.10 (177.0)	2.40 (3.6)	-12.4*** (-42.2***)
GDP Per Capita	145 (2002)	15,420 (14,223)	20,949 (20,011)	114,443 (118,651)	2 (2)	4 (5)	6,073 (5,188)	-10.9*** (-16.3***)
FB internal connect. (FB0)	145	25,656.0	35,906.7	23,8211.1	3.27	12.8	13,390.1	-3.2**
FB external connect. (FB1)	145	48,563k	125,499k	999,833k	6	41	11,462k	-10.3***
Social Capital	145 (2002)	53.28 (51.8)	8.81 (9.6)	41.6 (61.6)	0.82 (0.6)	0.53 (0.5)	51.54 (50.5)	-10.5*** (-7.5***)
Networks	2002	61.8	13.5	78.1	-1.0	1.1	64.0	-8.7***
Interp. trust	2002	37.5	13.5	80.4	1.1	1.3	34.4	-15.4***
Instit. trust	2002	49.2	15.5	83.9	0.2	-0.4	48.6	-7.9***
Relations	2002	67.9	15.3	88.5	-1.1	1.4	70.4	-8.5***
Civic particip.	2002	42.9	15.5	82.6	0.2	-0.3	41.5	-10.2***

Panel data descriptive statistics in parenthesis. ***p<0.01 **p<0.05 *p<0.1
Source: own calucation

The descriptive statistics of used data are presented in Table 1. The selection of countries is only based on the data availability criteria; 145 countries were included in the analysis, out of which 38 are from continental Europe, 47 from Africa, 32 from Asia, 14 from North America, 11 from South America, and 3 from Oceania. ADF test results confirmed stationarity for 0.01 alpha level for all variables.

Note that all the 3 sources of data used here have certain limitations. In particular, in the case of surveys, the main limitation is that the received data only reflects the respondents' publicly voiced answers, which may differ from reality. At the same time, in the case of social network data, it is necessary to take into account that they are not available in all countries of the world, just as not all members of society have access to the internet. In addition, all three sources refer to only some part of the world; the Legatum Prosperity Index contains data for 155 countries around the world from 2008 to 2022 period, the group participation data of World Value Surveys is available for on average 6 countries each year from 1981 to 2021 period, and Facebook's social connectedness index is for 145 (2020) countries only as of certain date yearly. Still, mentioned databases are the best available sources for now.

4. Results and discussion

As a result of correlation analysis (Table 2), moderately high correlation can be seen between the social capital index (reference period 2019) and GDP per capita (2019) indicators. The correlation coefficients are statistically significant only in case of four pairs: GDP growth and GDP per capita, social capital index and GDP per capita, internal connectedness index and GDP per capita, as well as between external and internal connectedness indexes.

Table 2. Correlation matrix of considered indicators (t-statistics in parentheses)[2]

	Growth	PerCapita	SC	FB0	FB1
Economic Growth, %	1				
GDP Per Capita	-0.2313*** (-2.843)	1			
Social Capital	-0.0155 (-0.186)	0.6668*** (10.70)	1		
FB internal connectedness (FB0)	0.0290 (0.0347)	-0.1536** (-1.859)	-0.1282 (-1.546)	1	
FB external connectedness (FB1)	0.0305 (0.365)	-0.0752 (-0.902)	-0.0448 (-0.536)	0.5093*** (7.078)	1

Significance of t-statistics: ***p<0.01 **p<0.05 *p<0.1
Source: own calucation

Yet, the Granger causality analysis shows a causal relationship between external social connectedness and GDP per capita indicators as well. Moreover, if in the first case the explanatory variable is GDP per capita meaning higher GDP per capita is a causation rather than a result of higher social capital index, in the second case the explanatory variable is the external connectedness index (Figure 1).

Significance of F-statistics: ***p<0.01 **p<0.05 *p<0.1.

Figure 1. Granger causality tests results for observed variables (source: Author's calculations. Here are presented only those pairs of indicators in which exists a causal relationship according to the test results).
Source: own calucation

It is worth noting that when conducting an OLS regression analysis on the same data, the following three equations satisfactory to the classical linear regression model conditions are obtained:

(1.1) *LOG(PERCAPITA) = -0.284*LOG(FB0) + 11.43*
(1.2) *LOG(PERCAPITA) = -0.233*LOG(FB1) + 12.52*
(1.3) *LOG(SC) = 0.064*LOG(PERCAPITA) + 3.41*

As for the value of the determination coefficients, which are very small in case of the first two equations (Table 3), it should be noted that it may be acceptable because social capital is not the main factor explaining the economic results in any well known model, and it is presented as a part of the coefficient "A" of institutional opportunities (e. g. Dasgupta P., 2002)

at best. Indeed, our goal is not to find a connection of necessarily high significance, but to test the hypothesis through the observed data.

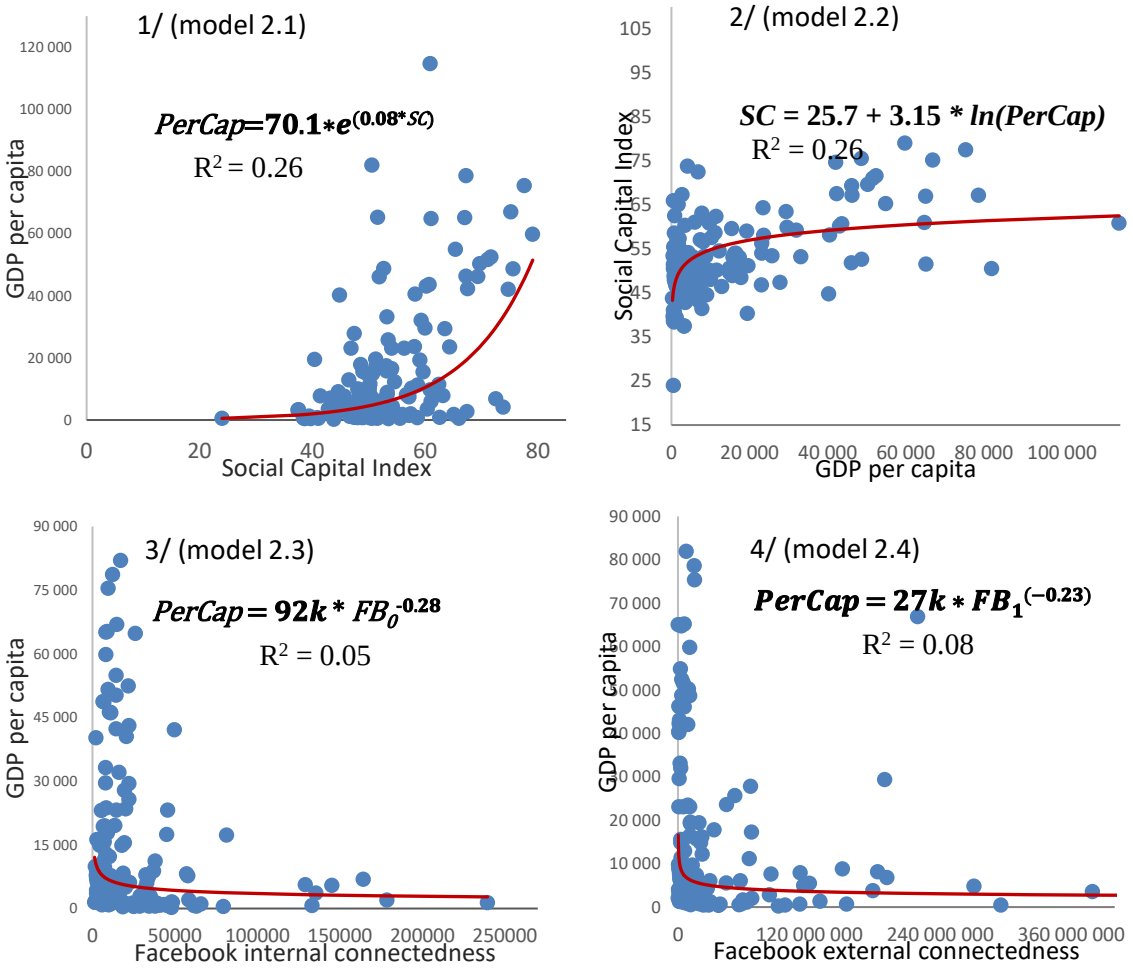


Figure 2. Nonlinear causal relationship functions for observed variables (social capital index, Facebook's connectedness index and GDP per capita).
Source: own calucation

Table 3. OLS regression models results.

	Model 1.1	Model 1.2	Model 1.3	Model 2.1	Model 2.2	Model 2.3	Model 2.4
N	145	145	145	145	145	145	145
R^2	0.046	0.075	0.338	0.264	0.264	0.046	0.075
Adjusted R^2	0.040	0.069	0.334	0.259	0.259	0.040	0.069
F stat	6.95^{***}	11.61^{***}	73.1^{***}	54.4^{***}	54.4^{***}	6.9^{***}	11.6^{***}

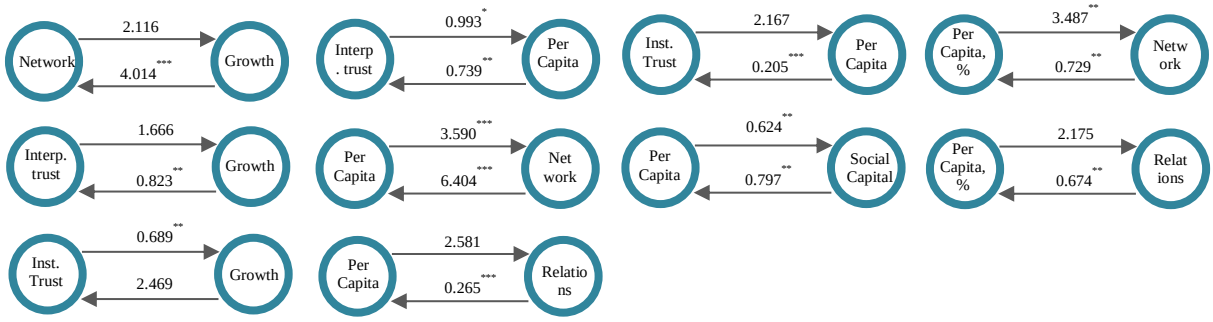
***p<0.01 **p<0.05 *p<0.1. Source: Authors' calculations. Note that when switching x and y in a regression model, the R coefficient and F statistic stay the same.
Source: own calucation

In figure 2 presented nonlinear modeals are selected based on visual appearance (transformed into linear when evaluating) on the connection between GDP per capita and social capital proxies. The first model tells us that an improvement of social capital index of a country by 1 point increases GDP per capita 1.08 times. Yet, as according to Granger causality test the explanatory variable is GDP per capita, from the 2nd model can be seen that when GDP per

capita increases, social capital increases as well, yet with decreasing rates. As for Facebook connectedness indexes, one can see that the connection is in negative direction. Yet the first (3rd) model, which considers Facebook's internal connectedness indicator, lacks compliance with classic linear regression model requirments with also lower value of R squared (in case of the Facebook external connectedness indicator, comparably better model characteristics are obtained). Note that according to Muringani J. and Fitjar R. (2021), bonding – within groups - social capital has even a negative and significant connection with economic growth when controlling for bridging – among groups - social capital, while the connection of bridging is positive and significant, which provides additional explanation for observed fenomena. Another reason for this may be that the data is incomplete, as because of some restrictions the data is available only for 145 countries. Also note that in different countries some other social networks are more popular, but pay attention to the fact, that this indicator is calculated as a probability to connect via Facebook, so the data is not biased by the number of users while it still can be sensitive to it.

One thing is certain for sure yet: the group of countries with relatively high GDP per capita have lower levels of social network connectedness. Is it possible that spending most of our time on online communication can hinder productive work, which in turn will be reflected in the country's poor performance? Of course, it is still difficult to answer this question unequivocally, but it should be noticed that the negative correlation (statistically insignificant) between the social capital indicator measured by traditional methods and the online networks indicators (Table 2) does not contradict the possible hypothesis.

Moreover, according to Dumitrescu Hurlin Panel Causality tests results, in case of the institutional trust and interpersonal elements the explaining variable is GDP per capita, in case of personal and family relations element the explaining variable is the latter, and in case of the networks element and overall social capital index (panel data), the connection is two-sided (Figure 3).



Significance of W and Zbar statistics: ***p<0.01 **p<0.05 *p<0.1

Figure 3. Dumitrescu-Hurlin Panel Causality Tests results for observed variables: social capital elements, GDP per capita and GDP growth.
Source: own calucation

As for economic growth, although according to the results of the panel regression analysis the elements of social capital do not contribute significantly to it, the results of the Dumitrescu Hurlin Panel Causality tests show a statistically significant interaction in some cases (social networks, interpersonal trust and institutional trust elements), which can be explained by the fact that developed countries have relatively low economic growth versus developing countries and they have already reaped the fruits of their high social capital, but this may need a deeper analysis with time lags experiments.

For sure, it will make sense to continue the analysis in individual country level. It should also be noted that according to the already obtained preliminary results, there is a moderately high correlation between GDP per capita and external connectedness index of RA administrative districts (0.52); moreover, a slight positive correlation (0.22) can also be seen between the social connectivity indicators of the Republic of Armenia and the indicators of mutual trade with the same countries. Almost the same picture is seen in case of the Republic of Belarus, as well as in case of the Republic of Georgia with minor deviations. Note that these deviations may have special reasons, like in the case of Samtskhe-Javakheti region of Georgia, which has a remarkably high connection with the regions of the Republic of Armenia (pushing the average indicator up), as many Armenians live there. The main finding here is the obvious positive correlation between the external social connectedness and gross regional product indicators. But pay attention to the fact that all 3 countries are developing countries.

To sum up, it's worth noting, however, that the analysis of the relationship between the RA social connectedness index and its economic outcomes (as well as for a group of other countries) is still in progress, which is especially important in the post-pandemic world and in a country defeated in the renewed war in Nagorno Karabakh as both of these factors are considered factors that reduce social capital (Isayan, 2020a, Isayan, 2020b).

5. Conclusions

Since the beginning of the last century, economists interested in social capital have proposed and used a number of methods to make social capital measurable: from surveys to game theory tools, from secondary data analysis to hybrid combinations of individual methods. The widespread use of social media around the world, however, has created other huge data on the subject, which still needs in-depth analysis as well as to be compared with the results of data collected in the traditional way, which was performed in this article.

Using mathematical-statistical methods of analysis of panel data it's shown in this work that there is a strong relationship between countries' GDP per capita indicator and social capital and that the most influential and statistically significant explaining variables of GDP per capita are institutional trust and networks elements of social capital (in case of the latter the connection is two-sided). As one could notice, there is also a causal relationship between external social connectedness (Facebook) and GDP per capita indicators. Moreover, if in the first case the explanatory variable is GDP per capita meaning higher GDP per capita is a causation rather than a result of higher social capital index (as GDP per capita increases, social capital increases as well, yet with decreasing rates - by a logarithmic function), in the second case the explanatory variable is the external connectedness index. In case of Facebook connectedness indexes, we saw that the connection is in negative direction with external connectedness indicator having comparably better model characteristics - the group of countries with relatively high GDP per capita have lower levels of social network connectedness. These findings are of high practical importance for both policy making – to determine which elements of social capital to invest in, and commercial decisions - for social media companies to analyze and to try to make virtual relationships look like real ones, as well as the buyers-users of their data.

In summary, it should be noted that there is a huge open field for research on this topic. For example, the obtained results can also be spread to country level data which is especially important in the post-pandemic world. In addition, it's suggested that developed countries, having relatively low economic growth versus developing countries, have already reaped the fruits of their high social capital, which may still need a deeper analysis with time lags experiments.

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NOTES

[1] Note that although the Legatum Prosperity index and Facebook's Social Connectedness Index are already available for 2021, GDP growth per capita and GDP growth figures are not available for most countries yet, which do not allow for comparisons of patterns with more recent data.

[2] Source: World Bank, Legatum Institute, Facebook data and author's calculations. FB0 is the social connected index inside the same country and FB1 is the average social connectedness index for the outside world. Here GDP and GDP per capita in current US dollar terms are considered. It should be noted that the correlation coefficient of PPP weighted indicators and social capital is lower (0.52 and 0.16 respectively).

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